Robert K. Clifton
Christ's College, Cambridge
CB2 3BU England
Home Tel. (0223) 328317
Hist./Phil. of Science Dept. FAX: (0223) 334554

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Prof. Daniel Greenberger
Department of Physics
City College of New York
New York, New York 10031
USA

Dear Professor Greenberger:

Thank you very much for your letter of Aug. 29/90. We (Prof. Redhead, Dr. Butterfield and myself) are glad that you substantially agree with Prof. Shimony who has written to us that he concurs with us completely on the issues we raised in our July 26/90 reply to both your referee reports. We shall send our revised manuscript, containing the changes we proposed, to Prof. van der Merwe, and also directly to you, in a few weeks time; and then we can take things from there.

Let me just respond to the two points that you have made in your letter. To understand our position, it is useful to distinguish the following three questions, and the answers we argued for in our July 26th reply:

(a) 'Do GHZ (Mason Symposium), GHZ/Shimony (i.e. your recent joint paper), and Greenberger (i.e. your lecture notes, which I received from David Mermin in April), claim to prove the constancy of result functions A, B, etc. for uncountably many settings?'

We reply: 'Yes' (cf. II(4) and III(7) of our July 26th reply)

(b) 'Is this claim justified?' We reply: 'No' (cf. III(7) of our July 26th reply)

(c) 'Is a proof possible which does not need to prove such constancy for uncountably many settings to reach a contradiction?' We reply: 'Yes' (cf. our paper, and Mermin's)

Let me first make clear that in our revised manuscript we do not intend to overplay the significance of question (a); after all, the really important point is that (c) can be answered positively, in light of the problem created by (b)'s negative answer. Be that as it may, it is still important that we understand eachother with regard to (a) and (b); for it seems from what you say that you do not agree with our answers above.

You will notice that our case for (a)'s answer is not based solely on GHZ's (Mason Symposium) use of the word "continuously", but is also based on the fact that in all three

documents mentioned in (a) above it is claimed that "$A_\lambda(\alpha)$ = constant, for all α" can be proved. Since α is a continuous parameter ranging over $[0,2\pi)$ (at least nothing is said in these documents to make the reader think otherwise), we claim that the quoted assertion is false - cf. (b) above. Your saying: "since one has here a function which equals only ± 1, if continuity entered there'd be nothing to prove" misses our point. We are not claiming that GHZ *assume* the continuity of the value of their result functions, A through D, for all α, β, etc. - as you say, that would be tantamount to assuming what they're trying to prove. Rather, what we are claiming in (b) above is that one cannot *prove* "$A_\lambda(\alpha)$ = constant, for all α in $[0,2\pi)$, etc.", but only the weaker assertion that "$A_\lambda(\alpha)$ = constant, for all α in any *countable subset* of $[0,2\pi)$, etc.". As we see it, nothing you've yet said has challenged this claim.

Of course, one way to get from the weaker to the stronger claim is to assume "continuity" of the result function values. But as we've agreed above, this just assumes what you are trying to prove - and it is a strategy we would never consider attributing to GHZ. However, another more plausible way to revive GHZ's (Mason Symposium) proof, which we pointed out in section IV of our July 26th response, is to (illegitimately) equate "measure-1" with "certainty". We believe that this is tacitly what GHZ (Mason Symposium) did; in particular, because they were operating with the EPR 'sufficient condition' for identifying an element of reality, which itself tacitly makes that equation. As we said in section IV of our July 26th reply, we intend in our revised manuscript to take due account of this fact; and of the plausibility of equating "measure-1" with "certainty".

With regard to your second point in paragraph 4 of your letter, we addressed this objection in section III(8) of our July 26th reply. To reiterate: It is true that we only use 5 sets of angles in our contradiction. But pg. 13, paragraph 2 of our paper already points out that since these 5 sets can be *chosen* in *uncountably* many different ways, this rules out the possibility that there may only be a measure-zero set of contradictions, contrary to what you are claiming. In fact, Professor Shimony in page 1, paragraph 2, line 13 of his referee report agreed with us on this point.

Thank you very much for taking the time to respond to our July 26th letter. You should receive our revised manuscript in a few weeks.

Yours sincerely,

Robert K. Clifton
(Written by myself,
after consultation with
Prof. Redhead and Dr. Butterfield)